Config Management

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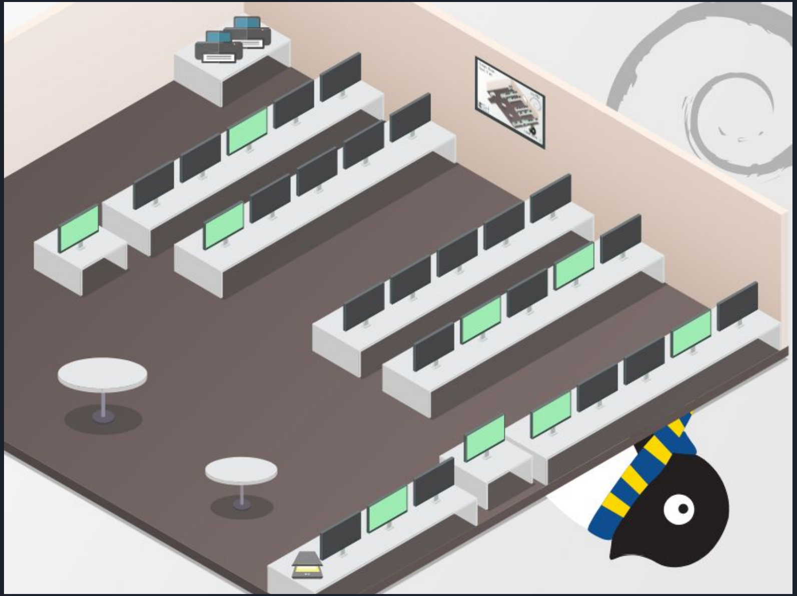
Who am I?

- OCF Site Manager
- EECS
- Firefighter
- I set up your student VMs
- Catch me in the ~~server room~~ OCF social discord

What problems does config management solve (1/3)?

- Suppose you have a bunch of computers



- You suddenly decide that everybody computer in the lab needs Minecraft installed
- Without config management: SSH into all the desktops and install it
- Even with a script this sucks
- Problem: How do you deploy updates to a fleet of existing computers?

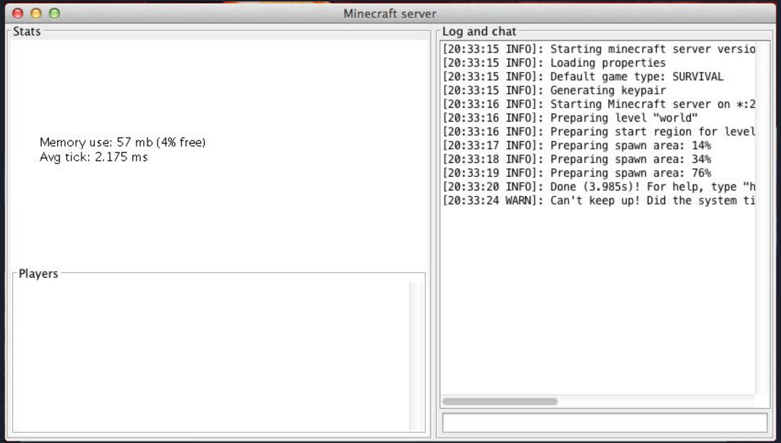
What problems does config management solve (2/3)?

- Suppose this computer lab buys a new computer

- Remembering to install Minecraft and configure it correctly is pretty difficult
  - Eg: Have it use more than 1Gb RAM by default
- Problem: How do you provision new machines?

What problem does config management solve (3/3)?

- Suppose you are running a Minecraft Server.

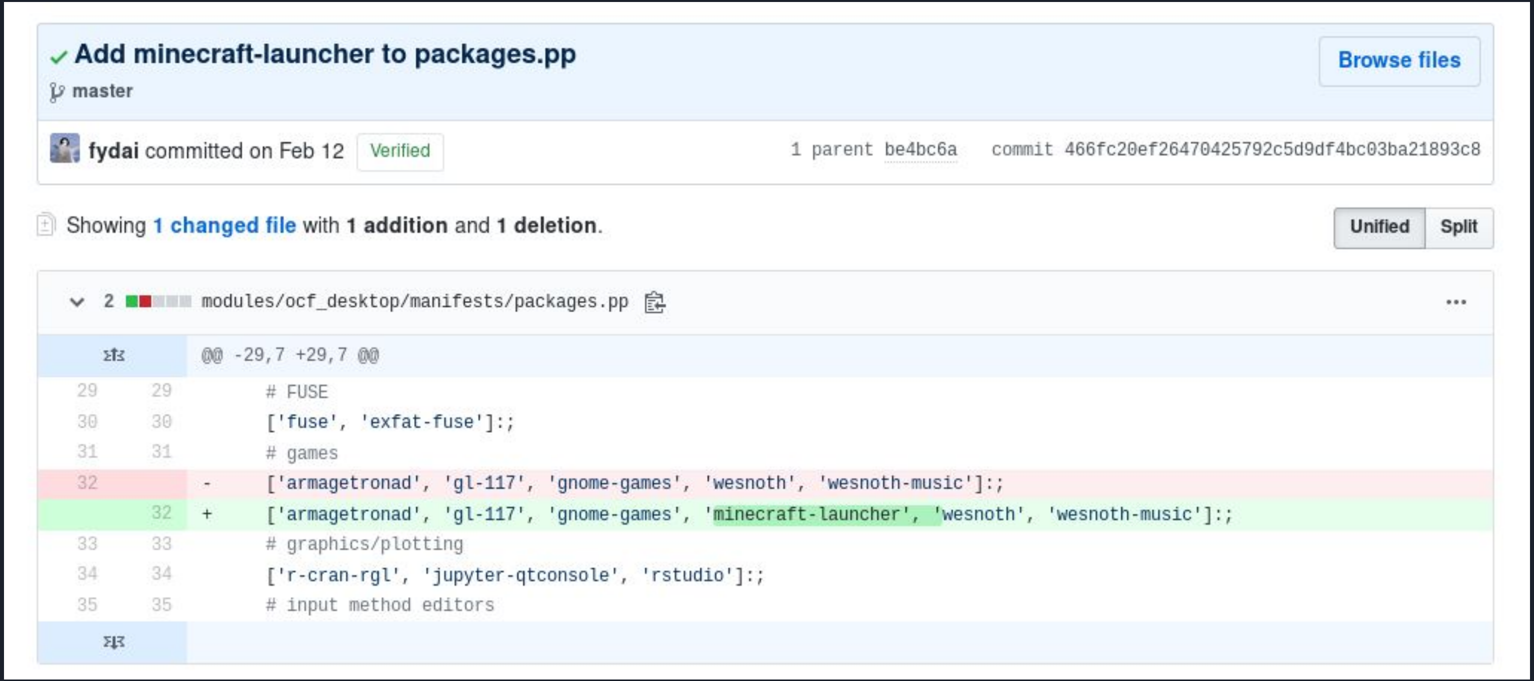


```
Memory use: 57 mb (4% free)
Avg tick: 2.175 ms
```

```
[20:33:15 INFO]: Starting minecraft server versio
[20:33:15 INFO]: Loading properties
[20:33:15 INFO]: Default game type: SURVIVAL
[20:33:15 INFO]: Generating keypair
[20:33:16 INFO]: Starting Minecraft server on *:2
[20:33:16 INFO]: Preparing level "world"
[20:33:16 INFO]: Preparing start region for level
[20:33:17 INFO]: Preparing spawn area: 14%
[20:33:18 INFO]: Preparing spawn area: 34%
[20:33:19 INFO]: Preparing spawn area: 76%
[20:33:20 INFO]: Done (3.985s)! For help, type "h
[20:33:24 WARN]: Can't keep up! Did the system ti
```

- You realize some change you made long ago broke some minor thing
- How do you figure out what settings you had changed around that time?
- Problem: How do you communicate what changes in software configuration to future you (and others)?

Config Management



Add minecraft-launcher to packages.pp

master

Browse files

fydai committed on Feb 12 Verified

```
1 parent be4bc6a    commit 466fc20ef26470425792c5d9df4bc03ba21893c8
```

Showing **1 changed file** with **1 addition** and **1 deletion**.

Unified Split

```
2 modules/ocf_desktop/manifests/packages.pp

@@ -29,7 +29,7 @@
        # FUSE
        ['fuse', 'exfat-fuse']:;
        # games
-       ['armagetronad', 'gl-117', 'gnome-games', 'wesnoth', 'wesnoth-music']:;
+       ['armagetronad', 'gl-117', 'gnome-games', 'minecraft-launcher', 'wesnoth', 'wesnoth-music']:;
        # graphics/plotting
        ['r-cran-rgl', 'jupyter-qtconsole', 'rstudio']:;
        # input method editors
```

Config management

- Solves problem 1 (updating computers) by having an unified update mechanism
- Solves problem 2 (bootstrapping new computers) by having all the changes necessary in some centralized repository
- Solves problem 3 (communicating new changes) by allowing you to use standard development practices (mainly git) to record your changes, and communicate with others

Configuration Management - Software that makes it as easy as possible to bootstrap new machines, configure running software, and allows configuration to be stored as code “configuration as code” philosophy

Configuration Management Philosophies

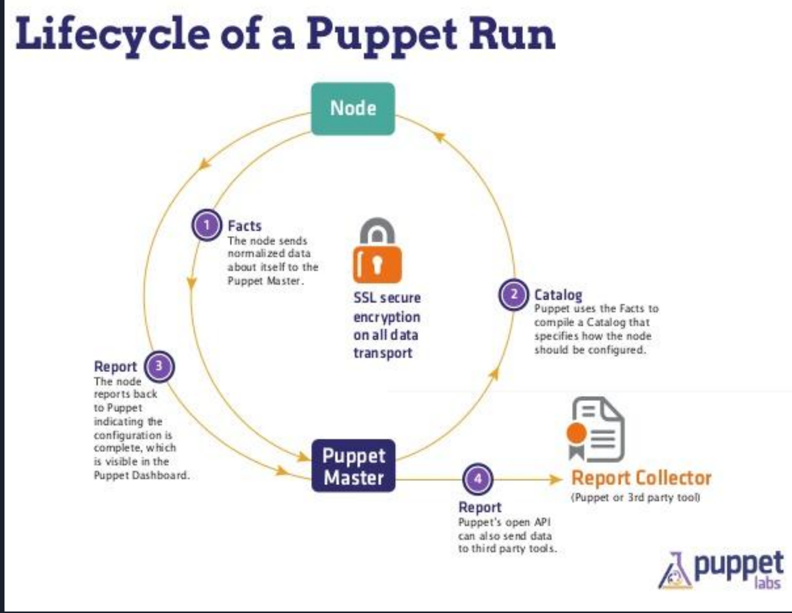
- Imperative:
  - Treats configuration as a “set of tasks”, order to be specified by you.
  - Say “How you want to do it”
  - “Install minecraft”, then “add a line to the config file”, then “run minecraft”
  - Examples: Chef, Ansible
  - Updates handled differently than Bootstrapping
  - What if config file is already edited?
- Declarative
  - Specify the final state, the system works to get itself into the state
  - Say “What you want, software figures out how to do it”
  - “Ensure minecraft is installed, the config file has line <X> in it, and ensure that minecraft is running”
  - Examples: Puppet
  - Updates are handled the same as Bootstrapping

Of course, this is not an either-or, any software will have aspects of both philosophies

Puppet

- Popular Configuration Management software
- Used for configuring individual machines
- Declarative philosophy, with some Imperative components when necessary
- Originally built on Ruby, now its own configuration language
- Used at places like
  - OCF (https://github.com/ocf/puppet)
  - CS 162 (https://github.com/Berkeley-CS162/vagrant/tree/master/modules/cs162)
  - Wikimedia (https://github.com/wikimedia/puppet)
  - Github
  - Lyft
- “Pull model” - Configured machines ask for an update
  - So Puppet is usually scheduled to be run every now and then (OCF has 30 minutes)

What happens when Puppet is run?

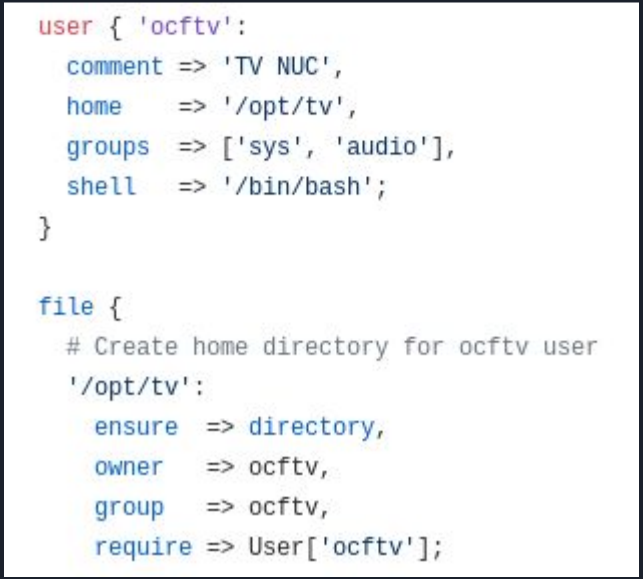

Lifecycle of a Puppet Run
Node
1 Facts The node sends normalized data about itself to the Puppet Master.
SSL secure encryption on all data transport
2 Catalog Puppet uses the Facts to compile a Catalog that specifies how the node should be configured.
Report 3 The node reports back to Puppet indicating the configuration is complete, which is visible in the Puppet Dashboard.
Puppet Master
4 Report Puppet's open API can also send data to third party tools.
Report Collector (Puppet or 3rd party tool)
puppet labs

- Client asks server for an update
  - "I want to be configured as a Minecraft Server"
- Server asks client for a list of Facts
  - "Ok, send me your hostname, and RAM"
- Client responds with the facts
  - "My hostname is zombies.ocf.berkeley.edu and I have 4GB RAM"
- Server responds with configuration
  - "Ensure the Minecraft server is running, with hostname zombies.ocf.berkeley.edu, 4GB RAM, with this configuration file
- Client makes the necessary changes to ensure its current configuration matches the configuration given by the server
  - "The minecraft server is currently running, but the configuration file has been updated, I will fetch the updated version

Puppet Code

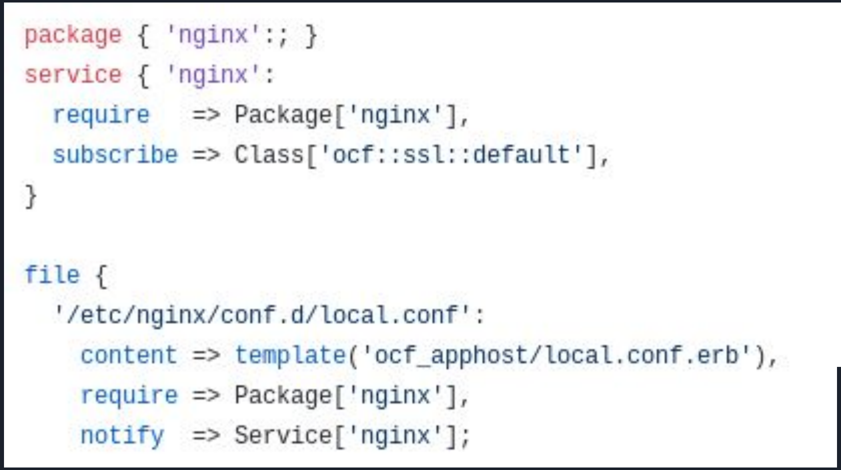
- Most of the code is here
    - Files - contains static files
    - Templates - contain templates (Ruby style)
    - Manifests - the heart of the configuration, specifies the desired states
- Other sections that are occasionally used
    - Facts - Ways to extract data needed for configuration
    - Functions - if you need extra something fancy data structure manipulating
- Dependencies need to be explicitly described
    - Puppet is allowed to run code in any order that it sees fit
    - If you have code installing Minecraft, and running Minecraft, you need to tell puppet to install Minecraft before running it

Example Puppet Code - Adding a user and a home directory

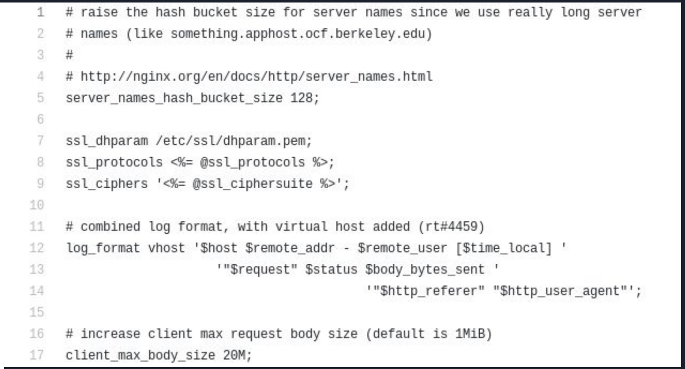


```
user { 'ocftv':
  comment => 'TV NUC',
  home    => '/opt/tv',
  groups  => ['sys', 'audio'],
  shell   => '/bin/bash';
}

file {
  # Create home directory for ocftv user
  '/opt/tv':
    ensure  => directory,
    owner   => ocftv,
    group   => ocftv,
    require => User['ocftv'];
```

Example Puppet Code - Running a web server



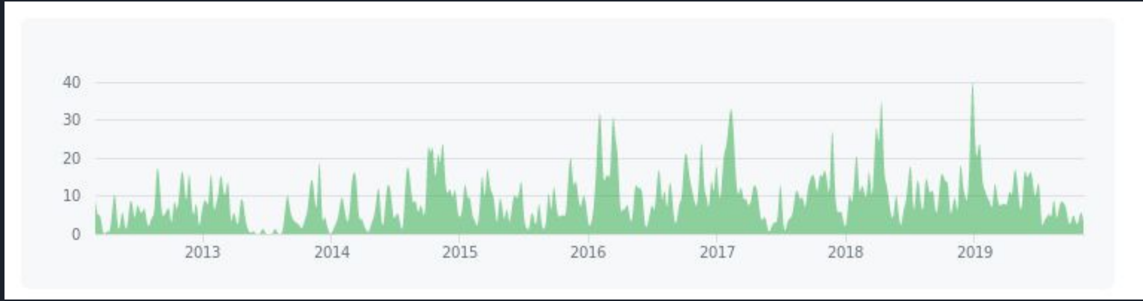
```
package { 'nginx':; }
service { 'nginx':
  require   => Package['nginx'],
  subscribe => Class['ocf::ssl::default'],
}

file {
  '/etc/nginx/conf.d/local.conf':
    content => template('ocf_apphost/local.conf.erb'),
    require => Package['nginx'],
    notify  => Service['nginx'];
```



```
# raise the hash bucket size for server names since we use really long server
# names (like something.apphost.ocf.berkeley.edu)
#
# http://nginx.org/en/docs/http/server_names.html
server_names_hash_bucket_size 128;

ssl_dhparam /etc/ssl/dhparam.pem;
ssl_protocols <%= @ssl_protocols %>;
ssl_ciphers '<%= @ssl_ciphersuite %>';

# combined log format, with virtual host added (rt#4459)
log_format vhost '$host $remote_addr - $remote_user [$time_local] '
                    '"$request" $status $body_bytes_sent '
                                        '"$http_referer" "$http_user_agent"';

# increase client max request body size (default is 1MiB)
client_max_body_size 20M;
```

Puppet at the OCF (1/2)

https://github.com/ocf/puppet



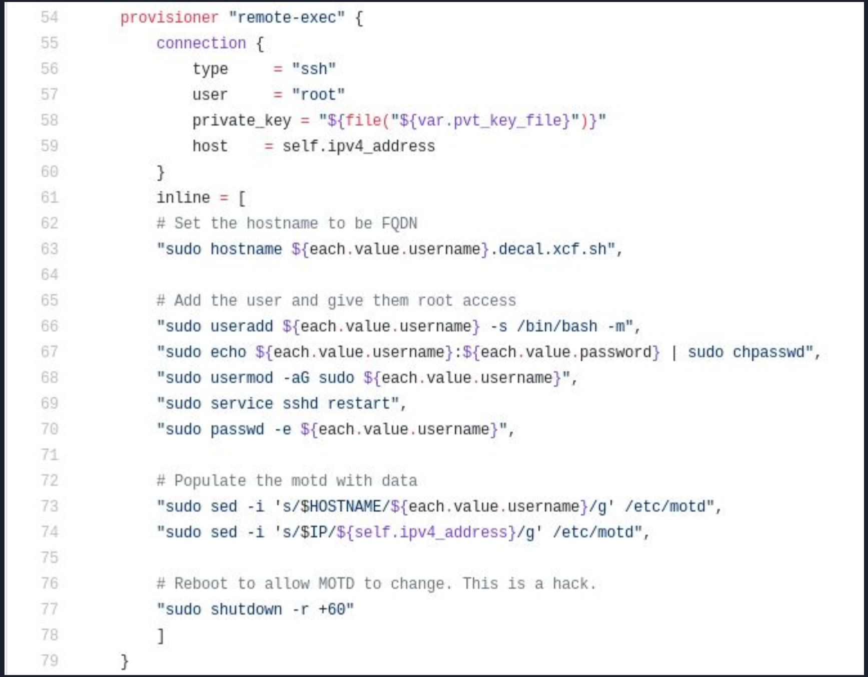
- Originally started in 2012, from the “Configuration is edited directly on the server, and desktops manually” model
  - We only had 10 desktops so this was kinda okay
- 7 years later, all of the OCF’s machines runs off the puppet repository
  - Desktops
  - Thing behind the TV
  - Hypervisors (things running the VMs)
  - VMs (Running all the Networked Services you learned about)
    - Including the puppet server itself

Puppet at the OCF (2/2)

- All the code is split into modules
  - Ocf_tv
  - Ocf_desktop
  - Ocf_www
  - Ocf_printhost
- Common OCF modules for shared configuration
  - Ocf::ssl for (I need a web certificate)
  - Ocf::auth for LDAP and Kerberos and sudoers configuration

Bonus Slide: Terraform

- Has integrated APIs to provision machines declaratively on cloud platforms
- This is part of the code used to generate your decal VMs. Notice that the provisioning script is mostly imperative.
- The alternative (which we seriously considered) was clicking “New droplet” 80 times.



```
    provisioner "remote-exec" {
        connection {
            type        = "ssh"
            user        = "root"
            private_key = "${file("${var.pvt_key_file}")}"
            host       = self.ipv4_address
        }
        inline = [
        # Set the hostname to be FQDN
        "sudo hostname ${each.value.username}.decal.xcf.sh",

        # Add the user and give them root access
        "sudo useradd ${each.value.username} -s /bin/bash -m",
        "sudo echo ${each.value.username}:${each.value.password} | sudo chpasswd",
        "sudo usermod -aG sudo ${each.value.username}",
        "sudo service sshd restart",
        "sudo passwd -e ${each.value.username}",

        # Populate the motd with data
        "sudo sed -i 's/$HOSTNAME/${each.value.username}/g' /etc/motd",
        "sudo sed -i 's/$IP/${self.ipv4_address}/g' /etc/motd",

        # Reboot to allow MOTD to change. This is a hack.
        "sudo shutdown -r +60"
        ]
    }
```

Thank you for your time!

The lab is up!

If you have any issues, or the lab is unclear, please don’t hesitate to ask me questions! Also ask in #decal-general